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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/789,387	02/26/2004	Lei Shao	042390.P16330	4947

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EXAMINER	
NGUYEN, LEON VIET Q	
ART UNIT	PAPER NUMBER
2611	

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11/10/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/789,387	SHAO ET AL.	
	Examiner	Art Unit	
	LEON-VIET Q. NGUYEN	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 29-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,29-31,33 and 35* is/are rejected.

7)☒ Claim(s) *32,34,36 and 37* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/20/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to communication filed on 10/20/09. Claims 24-28 have been cancelled. Claims 1 and 29-37 are pending on this application.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/14/09 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 1 recites the limitation "the submatrices from the G groups". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 30, 31, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boariu et al (US6865237) in view of Lee et al ("A Space-Frequency Transmitter Diversity Technique for OFDM systems", Globecomm 2000, IEEE Global Telecommunications Conference; November 27, 2000) and Giannakis et al (US7224744).

Re claim 1, Boariu teaches receiving content for transmission (receiver 302 in fig. 3) over a plurality of three or more transmit antennae (antennas 314, 316, and 318 in fig. 3); and

generating a rate-one (col. 12 lines 51-53), space-frequency code matrix (col. 12 lines 38-50) from the received content for the transmission via transmit antennae (antennas 314, 316, and 318 in fig. 3); and

transmitting the rate-one space-frequency matrix via the plurality of transmit antennae (320 in fig. 3)

Boariu fails to teach a method wherein the received content is a vector of input symbols of size *Nc* x 1, wherein *Nc* is the number of subcarriers of the multicarrier wireless communication channel.

However Lee teaches wherein a received content is a vector of input symbols of size *Nc* x 1 (*pg. 1474,* right column, first paragraph), wherein *Nc* is the number of subcarriers of the multicarrier wireless communication channel (equation (1), Xo(n)-Xl*(n)... 'Xn-2(n)-Xn-l*(n) and Xl(n)...Xn-2"(n) are interpreted to be corresponding to the

number of subcarriers). Furthermore, the number of transmit antenna being "M" is interpreted to be some arbitrary variable.

Therefore taking the combined teachings of Boariu and Lee as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the step of Lee into the method of Boariu. The motivation to combine Lee and Boariu would be to provide higher gain than conventional OFDM systems (page 1475 right side first paragraph of Lee).

Boariu also fails to teach a method wherein generating a rate-one space frequency code matrix comprises:

dividing the vector of input symbols into a number G of groups to generate subgroups;

multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (Vg);

dividing each of the pre-coded vectors into groups of subvectors, and utilizing the subvectors to generate a diagonal matrix; and

interleaving the submatrices from the G groups to generate an M x Nc space-frequency matrix.

However Giannakis teaches dividing the vector of input symbols into a number G of groups to generate subgroups (col. 9 lines 1-15; col. 10 lines 15-23);

multiplying at least a subset of the subgroups by a constellation rotation precoder to produce a number G of pre-coded vectors (col. 9 lines 1-15; col. 10 lines 15-23);

dividing each of the pre-coded vectors into groups of subvectors, and utilizing the subvectors to generate a diagonal matrix (col. 9, lines 45-60 and col. 10, lines 15-23); and

interleaving the L submatrices from the G groups to generate an M x Nc space-frequency matrix (col. 9, lines 32-55).

Therefore taking the combined teachings of Boariu and Giannakis as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the step of Giannakis into the method of Boariu. The motivation to combine Giannakis and Boariu would be to achieve maximum space path diversity order (col. 10 lines 45-53 of Giannakis).

Re claim 30, the modified invention of Boariu teaches a method wherein dividing the vector of input symbols into G groups comprises:

dividing each vectors of input symbols into G groups of (ML) x 1 vectors (col. 9 lines 1-15 and col. 10 lines 15-23 of Giannakis), wherein L is a number of matrix channel taps (col. 2 lines 30-31 of Giannakis) and wherein Nc = M x L x G (col. 9, lines 45-60 and col. 10, lines 15-23 of Giannakis).

Re claim 31, the modified invention of Boariu fails to explicitly teach wherein the input symbols are QAM symbols. However QAM is a well known modulation technique which is used in OFDM systems such as the system taught by Boariu.

Re claim 33, the modified invention of Boariu teaches a method wherein dividing each of the pre-coded vectors into groups of subvectors comprises:

dividing each of the pre-coded vectors into a number of LM x 1 subvectors, and utilizing the subvectors to generate an M x M diagonal matrix (col. 9, lines 45-60 and col. 10, lines 15-23 of Giannakis).

Re claim 35, the modified invention of Boariu teaches a method further comprising encoding the content using a modulation technique (col. 4 lines 40-43 of Boariu).

3. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boariu et al (US6865237), Lee et al ("A Space-Frequency Transmitter Diversity Technique for OFDM systems", Globecomm 2000, IEEE Global Telecommunications Conference; November 27, 2000) and Giannakis et al (US7224744) in view of El-Gamel et al (US701053).

Re claim 29, the modified invention of Boariu fails to teach Boariu fails to teach a method wherein the transmission provides full space-frequency diversity of M*N*L, where N is a number of receiver antenna.

However El-Gamel teaches a plurality of receive antennae (col. 3 lines 37-42) and providing full space-frequency diversity of M*N*L (col. 3 lines 35-37, col. 13 line 61 – col. 14 line 20 , Table 3), where N is number of receiver antenna (col. 14 lines 56-59, L_{ISI} in Table 3. Each path corresponds to an antenna.

Therefore taking the combined teachings of Boariu, Lee, and Giannakis with El-Gamel as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the step of El-Gamel into the method of Boariu, Lee, and Giannakis. The motivation to combine El-Gamel, Boariu, Lee, and Giannakis would be to advantageously maximize spatial and temporal diversity (col. 3 lines 41-42 of El-Gamel).

Allowable Subject Matter

4. Claims 32, 34, 36, and 37 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEON-VIET Q. NGUYEN whose telephone number is

(571)270-1185. The examiner can normally be reached on Monday-Friday, alternate Friday off, 7:30AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David C. Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Leon-Viet Q Nguyen/
Examiner, Art Unit 2611

/David C. Payne/
Supervisory Patent Examiner, Art Unit 2611